

We claim:

1. A method for patterning an IC (integrated circuit) material, comprising:
forming a rigid organic under-layer over the IC material;
patterning the rigid organic under-layer to form a rigid organic mask structure; and
5 trimming the rigid organic mask structure to lower a critical dimension of the rigid
organic mask structure.

2. The method of claim 1, further comprising:
etching away any portion of the IC material not under the rigid organic mask
10 structure.

3. The method of claim 1, wherein the step of patterning the rigid organic under-
layer includes the steps of:
forming a layer of photo-resist on the rigid organic under-layer;
15 patterning the photo-resist in a photolithography process; and
etching away any portion of the rigid organic under-layer not under the photo-
resist.

4. The method of claim 3, wherein the photo-resist remains on top of the rigid
20 organic mask structure after the step of trimming.

5. The method of claim 3, wherein the photo-resist is completely stripped away
from top of the rigid organic mask structure after the step of trimming.

25 6. The method of claim 3, wherein the rigid organic under-layer is opaque to light
used in the photolithography process to act as a BARC (bottom anti-reflective coating)
during patterning of the photo-resist.

7. The method of claim 3, wherein the rigid organic under-layer is transparent or
30 semi-transparent to light used in the photolithography process.

8. The method of claim 1, further comprising:
forming a hard-mask layer between the IC material and the rigid organic under-layer;
etching away any portion of the hard-mask layer not under the rigid organic mask
5 structure to form a hard-mask structure; and
etching away any portion of the IC material not under the hard-mask structure.

9. The method of claim 8, wherein material of the rigid organic under-layer
remains on top of the hard-mask structure.

10. The method of claim 8, wherein material of the rigid organic under-layer is
completely stripped away from top of the hard-mask structure.

11. The method of claim 1, wherein the rigid organic under-layer is comprised of
15 one of an aromatic addition polymer, an aromatic condensation polymer, or a non-aromatic crystalline polymer; or a carbon film deposited using one of methane, ethane, ethylene, propane, or propylene, in a CVD (chemical vapor deposition) process.

12. The method of claim 1, wherein the critical dimension of the rigid organic
20 mask structure is trimmed to be in a range of from about 10 nanometers to less than about 50 nanometers.

13. A method for patterning a polysilicon layer, comprising:
depositing the polysilicon layer, on a semiconductor substrate, with a thickness in
25 a range of from about 500 Å to about 2,500 Å;
depositing a hard-mask layer on the polysilicon layer, with the hard-mask layer being comprised of silicon nitride (SiN) and having a thickness in a range of from about 100 Å to about 700 Å;
depositing a rigid organic under-layer, on the hard-mask layer, with a thickness in
30 a range of from about 100 Å to about 700 Å;
wherein the rigid organic under-layer is comprised of one of an aromatic addition

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polymer, an aromatic condensation polymer, or a non-aromatic crystalline polymer; or a carbon film deposited using one of methane, ethane, ethylene, propane, or propylene, in a CVD (chemical vapor deposition) process;

depositing a photoresist layer, on the rigid organic under-layer, with a thickness in
5 a range of from about 1,000 Å to about 5,000 Å;

patterning the photo-resist in a photolithography process to form a photoresist mask structure;

wherein the rigid organic under-layer is opaque to light used in the photolithography process to act as a BARC (bottom anti-reflective coating) during
10 patterning of the photo-resist;

etching away any portion of the rigid organic under-layer not under the photo-resist mask structure to form a rigid organic mask structure;

trimming the rigid organic mask structure to have a critical dimension in a range of from about 10 nanometers to less than about 50 nanometers;

15 wherein the photo-resist is completely stripped away from the top of the rigid organic mask structure after the trimming step;

etching away any portion of the hard-mask layer not under the rigid organic mask structure to form a hard-mask structure;

wherein material of the rigid organic under-layer remains on top of the hard-mask
20 structure; and

etching away any portion of the IC material not under the hard-mask structure to form an IC structure having the critical dimension of the rigid organic mask structure.

14. A system for patterning an IC (integrated circuit) material, comprising:
25 a deposition unit for forming a rigid organic under-layer over the IC material;
means for patterning the rigid organic under-layer to form a rigid organic mask structure; and

means for trimming the rigid organic mask structure to lower a critical dimension of the rigid organic mask structure.

30 15. The system of claim 14, further comprising:

means for etching away any portion of the IC material not under the rigid organic mask structure.

16. The system of claim 14, wherein the means for patterning the rigid organic under-layer includes a photolithography unit for patterning a layer of photo-resist on the rigid organic under-layer.

17. The system of claim 16, wherein the photo-resist remains on top of the rigid organic mask structure after trimming.

18. The system of claim 16, wherein the photo-resist is completely stripped away from top of the rigid organic mask structure after trimming.

19. The system of claim 16, wherein the rigid organic under-layer is opaque to light used in the photolithography unit to act as a BARC (bottom anti-reflective coating) during patterning of the photo-resist.

20. The system of claim 16, wherein the rigid organic under-layer is transparent or semi-transparent to light used in the photolithography unit.

21. The system of claim 14, further comprising:
a hard-mask layer formed between the IC material and the rigid organic under-layer;

means for etching away any portion of the hard-mask layer not under the rigid organic mask structure to form a hard-mask structure; and

means for etching away any portion of the IC material not under the hard-mask structure.

22. The system of claim 21, wherein material of the rigid organic under-layer remains on top of the hard-mask structure.

23. The system of claim 21, wherein material of the rigid organic under-layer is completely stripped away from top of the hard-mask structure.

24. The system of claim 14, wherein the rigid organic under-layer is comprised of
5 one of an aromatic addition polymer, an aromatic condensation polymer, or a non-aromatic crystalline polymer; or a carbon film deposited using one of methane, ethane, ethylene, propane, or propylene, in a CVD (chemical vapor deposition) process.

25. The system of claim 14, wherein the critical dimension of the rigid organic
10 mask structure is trimmed to be in a range of from about 10 nanometers to less than about 50 nanometers.